Finding the Right Role: An Analysis of Major League Baseball Pitching Roles

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Abstract

The average length of a starting pitcher's outing has declined due to the change in the philosophy behind managing a pitching staff. Today's starting pitchers average 5.1 innings per game, a significant decline since 2013. In wake of this revolution, more dynamic pitching roles have been introduced and league-wide bullpen structure is less defined than ever before. Since 2021, 240 pitchers with a minimum of 50 games played have appeared in both starting and relieving roles. In this project, we aim to formulate and implement a statistical analysis to better understand how pitchers can be maximized in specific roles – and who are potential candidates.

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INTRODUCTION

1.1 Pitching Roles

We don't believe that the traditional roles of "starter" and "reliever" accurately reflect how pitching staffs are managed in today's game. We choose to keep the starter label, but only for starting pitching prospects that are too young to give up on and starters that have established themselves in Major League Baseball as pitchers who can consistently go 5 or more innings into games while providing average to above average run prevention. Additionally, relievers who are already pitching short outings aren't candidates for moving roles, as almost every reliever failed as a starter at one point in their career. We aim to identify pitchers who are currently starting games, but have production that is subpar to what could be done with their pitch arsenal. When pitchers are moved into the bullpen, they can throw harder and don't have to worry about facing batters several times throughout the game, allowing them to throw more effective pitches more often.

1.2 Limitations

Because we aren't involved with organizations' day-to-day operations, we are unaware of what goes on behind the scenes. Factors like player contracts and supporting roster talent can also influence a starter's role, along with the player's individual role demands.

1.3 Research Aims

Our vision for this project is to identify the ceiling of a starter becoming a reliever. We also want to showcase what metrics we think could be used to identify candidates for the role change.

1.4 Data

All the data comes from the provided Savant and Fangraphs files, which contain season-level and play-by-play data from the 2021-2023 seasons.

METHODS

2.1 Run Value (RV)

Based on the situation, RV attempts to quantify how effective a pitch is; baseball Savant has a stat called Delta Run Expectancy (DRE), which calculates the change in Run Expectancy before and after the Pitch. If we take the average number of runs scored in particular situations, we get Figure 2.1:

Runners	0 Outs	1 Out	2 Outs
Empty	0.461	0.243	0.095
1 _ _	0.831	0.489	0.214
_ 2 _	1.068	0.644	0.305
1 2 _	1.373	0.908	0.343
_ _ 3	1.426	0.865	0.413
1 _ 3	1.798	1.140	0.471
_ 2 3	1.920	1.352	0.570
1 2 3	2.282	1.520	0.736

Figure 2.1: Run Expectancy table of the average number of runs scored in the 24 unique situations of runner and out state. Source: Fangraphs

A batter's expected wOBA will change based on the count and the result of a pitch; this change in expected wOBA calculates the weighted runs above average ("wRAA") change. The r-squared value between RV and Delta Run

Figure 2.2: Starting Pitcher's Run-Value on the top 4 most used pitches in the dataset over the course of a game.

Expectancy shows that 38% more outcomes were accounted for under RV. In 2023, Gerrit Cole, Kevin Gausman, and George Kirby led the way with run values of -58, -47, and -45, respectively. Looking at individual pitches, Logan Webb's changeup led all Starters in RV in 2023 at -35. Regarding starters' RV throughout the game, their pitches tend to improve steadily. Because of the fewer observations that feature starters working into the back third of a game, RV tends to become more volatile towards the end of contests (see Figure 2-2).

2.2 Filters

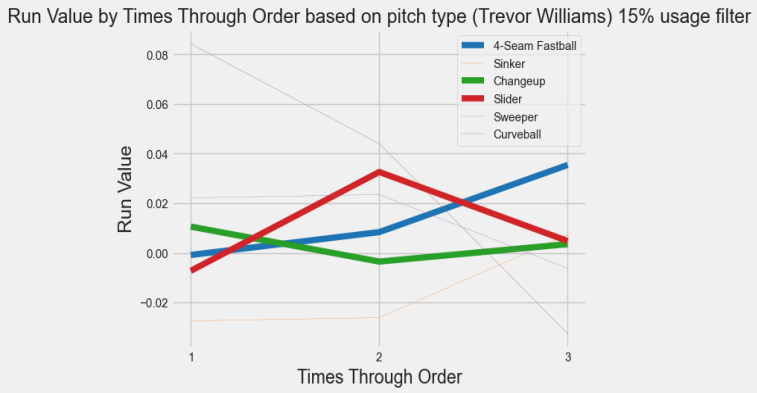
When evaluating potential candidates for a role change, we initially eliminate pitchers who already hold bullpen roles and experienced an injury-shortened 2023. Setting a filter of 20 or more games started and an xFIP- of over 115, 17 pitchers became potential candidates. Evaluating them individually to determine viability, we discard some due to age. Other discarded nominees and our justification for each choice are listed below. This leads to our final three candidates, whom we will discuss in depth.

Name	GS	ERA	IP	WHIP	Reason
Reid Detmers	28	4.48	148.2	1.352	Too young to have realized his potential as a starter.
Kutter Crawford	23	4.04	129.1	1.106	Still young, has improved every year since making a debut
Tanner Houck	21	5.01	106.0	1.368	Had excelled in the bullpen role previously and may already be destined for a return to the pen.
JP Sears	32	4.54	172.1	1.265	Gives up hard contact at a far too high rate for a reliever without the stuff to make up for it.
Tony Gonsolin	20	4.98	103.0	1.223	Regressed in 2023, but is just one year removed from an All-Star season in the rotation and a bullpen move may be an overreaction.

CANDIDATES / RESULTS

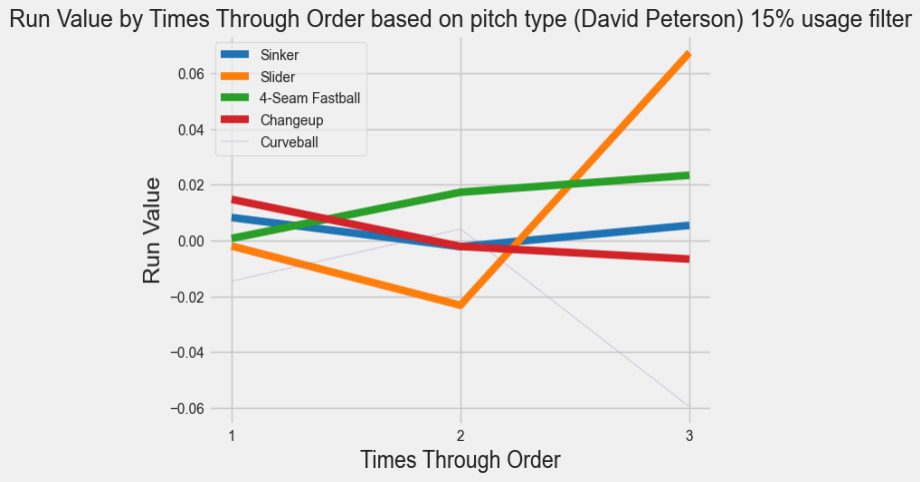
3.1 Trevor Williams

This leads to our final three candidates to discuss in depth. Trevor Williams is the first candidate to move to the bullpen in a swingman role. Looking back at the two seasons before 2023, his fastball, which he used over 50% of the time in 2022, sticks out as elite. Allowing just a 0.224 xBA and a 0.284 xwOBA against, Williams' fastball was ranked in the 94th percentile of run value provided. After two strong seasons with the Mets, averaging just under 3 innings per appearance over 30 games, the Nationals brought him in to start. However, under an increased workload in 2023, his fastball suffered. While it was still his most valuable pitch, his usage of it dropped ~10%, and the average velocity was down 1.5mph from the previous season. He made 30 starts in 2023, with rather poor results: 5.55 ERA, 119 xFIP-, and a league-leading 34HR allowed. However, Williams could provide upside as a bullpen arm. We attribute this to his move to the rotation, as in 2023, he threw 54 more innings than the previous season and was averaging nearly 2 more innings pitched per outing than with the Mets. A graph of his run value through the order shows that his fastball got progressively less valuable on his second and third time through the order, while his other pitches remained the same. In 2024, a decreased workload out of the pen could see Williams return to his 2022 form as a high-level swingman with a strong pitch mix, allowing him to deliver a combination of innings and high-level pitching out of the bullpen.



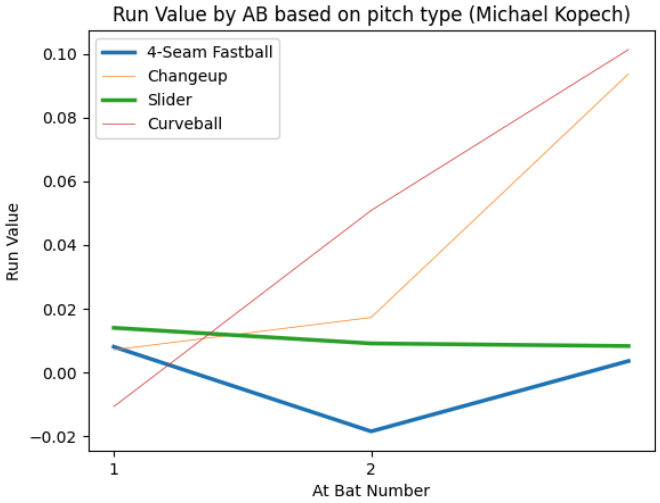
3.2 David Peterson

David Peterson had an excellent xFIP-, 82.8, but every other statistic reported the opposite. With a 5.24 ERA and 125.7 ERA- during his 21 starts this season, Peterson wasn't effective. However, the 42 point difference between his ERA- and xFIP- made Peterson stand out during our analysis - far higher than the 2023 average of 13 points. The reason behind this gulf is Peterson's ability to induce ground balls. His average launch angle was just 5.3°, and a further look into his hit-type percentages shows that his GB/FB ratio is an outstanding 1.20. Peterson allowed more hard contact in 2023 than years prior, particularly on his sinker, but this contact was primarily directly into the ground, with a -4° launch angle average for that pitch. His BABip confirms our suspicions, as it was 0.371, despite a 53.9 GB% figure. We project Peterson to be extremely valuable out of the pen as a multi-inning reliever who can keep batted balls on the ground - an increasingly valuable trait with the surge in focus on elevating contact.



3.3 Michael Kopech

Finally, we come to our group's favorite prospect for a bullpen move: Michael Kopech. The White Sox flamethrower's 2023 campaign was a major step back from his previous two, as Kopech shouldered the heaviest pitching load since his Tommy John surgery in 2018. He started 27 games, throwing 126.2 innings, and posted the worst numbers of his career. His xFIP- of 133.03 was the worst in the league among pitchers with minimum 20 starts. This comes from a 2022 season where his xFIP- was 122.89 - another subpar mark. However, Kopech still holds elite swing-and-miss stuff. His two pitches - 4-seam fastball and slider - boast Whiff percentages of 26.4% and 27.4%. Kopech's reliance on just a two-pitch mix, making up 88.2% of his pitches thrown, limits his viability to go deeper in games, and matches the profile of a high-leverage reliever instead. This is evident when analyzing his Run Value trends, as Kopech breaks the general MLB trend of decreasing run value throughout the game with his fastball and slider, which both remain identical throughout the game, while his sparsely used changeup and curveball skyrocket in value each time through the order.



3.4 Conducting a Comparison

To give an idea about the ceiling of our candidates in a bullpen role, we ran an Euclidean Model to find some of the top MLB relievers who have similar pitch characteristics to our candidates. The Euclidean Matrix helps us calculate the distance between quantifiable pitcher characteristics using the following formula where x: represents the average metrics for the target reliever, and y represents the average metrics of each reliever. Using an 11-dimension vector space, we calculated players with metrics closest to our target player. Our elite ceiling comparisons are as follows:

$$d_{L2}(x, y) = \sqrt{\sum_{i=1}^{n} (x_i - y_i)^2}$$

Player	**Pitch Comparison**
Michael Kopech	Matt Brash (Closest pitch- Fastball 16, points)
David Peterson	Kyle Finnegan (Closest pitch- Slider, 9 points)
Trevor Williams	Genesis Cabrera (Closest pitch- Fastball, 17 points)